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STUDY PROJECT

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MAINTENANCE CONCEPT
FOR MOBILE SUBSCRIBER EQUIPMENT

BY

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describes the maintenance concept which has been developed to support the Mobile Subscriber Equipment. An evaluation is made of the effectiveness of the concept in a war fighting mode. A conclusion has been drawn that; with minor exceptions, the maintenance concept is adequate to sustain MSE in combat. Recommendations are offered where the author feels the concept can be improved.

USAWC MILITARY STUDIES PROGRAM PAPER

**MAINTENANCE CONCEPT
FOR MOBILE SUBSCRIBER EQUIPMENT**

AN INDIVIDUAL STUDY PROJECT

by

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23 March 1987**

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ABSTRACT

AUTHOR: ROY J. BURDINE, LTC, SC

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Based on evolving technology and the need for a more responsive and flexible communications system, one of the largest procurement programs ever conducted by the U.S. Army began in the early 1980's. The acquisition program is for a cellular communications system which will significantly enhance command and control capabilities within the corps and division as those units employ the airland battle doctrine. This new operational capability cannot be successful unless an accompanying maintenance concept is incorporated to insure a high degree of operational availability of the equipment. This research project describes the maintenance concept which has been developed to support the Mobile Subscriber Equipment. An evaluation is made of the effectiveness of the concept in a war fighting mode. A conclusion has been drawn that, with minor exceptions, the maintenance concept is adequate to sustain MSE in combat. Recommendations are offered where the author feels the concept can be improved.

*Keywords: radio telephones,
Tactical Communications; Airland Battle Doctrine.*

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CHAPTER I

INTRODUCTION

The United States Army, the Signal Corps in particular, has commenced the acquisition of a new command and control communications system which will revolutionize combat communications from corps to brigade level. This cellular system radiotelephone will provide the flexible tactical communications necessary to prosecution of airland battle doctrine.¹ This acquisition program will effect all communications means except high frequency and single channel FM voice. Although there will be no new equipment acquisition for these two means there will be operational changes. The impact of the Mobile Subscriber Equipment (MSE) program will be significant within the U.S. Army.

The objective of this study is to determine if the maintenance concept for MSE will be effective in maintaining and sustaining an operationally adequate system with the capability of providing the command and control requirements of the airland battle environment.

CHAPTER 1

ENDNOTES

1. Eric C. Ludvigsen, "Today Battles Tomorrow in Army Budget-Making," Army, March 1987, p. 17.

CHAPTER II

BACKGROUND

The Operational and Organizational Plan explains that the MSE program is a result of the mission area analysis, a subprocess of the Concept Based Requirements System conducted by the U.S. Army Signal Center at Fort Gordon, Georgia. The concept was formalized by this process but was influenced by other factors.

One of the biggest factors contributing to the initiation of the concept was manpower. In 1982, the Vice Chief of Staff of the Army was briefed that by 1990 the personnel required by the Signal Corps to field incoming equipment to meet communications requirements would increase by approximately 5800. This conflicted with the initiative to create two additional divisions in the Army, therefore new direction was given to the Signal Corps immediately. The Corps would not be allowed to increase personnel requirements, but would have to find a way to decrease them by approximately 5000.

The challenge became that of providing communications for the future airland battlefield earlier, with fewer dollars, less manpower and greater capability.¹ The Signal Center's new analysis resulted in an operational concept known as the Mobile Subscriber Grid System which is an interconnecting grid of signal nodals established throughout the area of operation. The equipment acquisition for this concept is called the Mobile Subscriber Equipment (MSE) program.

To have a real understanding of the improvements and impact of this new communications system and the requirement for a sound maintenance concept, one must understand what commanders and signal troops have to operate with today. The current corps and division systems were developed separately before airland battle doctrine and philosophy were adopted. These systems use different equipment and cannot provide the rapid connectivity required between division and corps. Although connectivity exists, it is not sufficiently responsive to maneuver requirements. The role of the corps in airland battle doctrine makes rapid connectivity and responsive communications an essential requirement.

The current equipment does not allow users to rapidly and conveniently access the telephone system from a mobile configuration. The interface between the caller and his party is accomplished manually and only one call can be made at a time. This method of operation is too slow for airland battle requirements. On a fluid battlefield where decisions must be made quickly and where dispersion is of utmost importance, the communications system must be flexible and responsive.

Another factor which detracts from the effectiveness of the current system is the time it takes for installation, particularly in displacing of communications equipment. Airland battle doctrine requires frequent displacements of battle headquarters. Tactical requirements for increased flexibility and mobility dictate an increasing reliance on mobile communications.² The demands on the communications system have increased many fold.

The age of the equipment which makes up the current system reduces its effectiveness because maintenance problems are increased. Equipment becomes inoperable more frequently. The movement requirements increase the downtime because displacing the old equipment more frequently causes it to become inoperable. Users understand that maintenance is a very important factor in continuing the battle, but if communications equipment cannot be repaired in a timely manner, which means minimum downtime, more inefficient means of command and control such as numerous face-to-face coordination meetings, or messengers, become necessary.

Time is of the essence in airland battle. Agility, synchronization, initiative and deception are difficult to achieve if the command and control communications system is unresponsive. Reliable communications are the heart of command and control.³ The basic assumption I have made is that MSE meets the operational needs of the communications system required for corps and division to be successful in the airland battle scenario.

CHAPTER II

ENDNOTES

1. US Department of the Army, Operational and Organizational Plan for Mobile Subscriber Equipment (MSE) Systems, p. 1-1.
2. Ibid.
3. US Department of the Army, Army Field Manual 100-5, p. 52.

CHAPTER III

METHODOLOGY

In this project I compared currently practiced maintenance concepts of the Army with the MSE maintenance concept to determine if the latter is adequate to support and sustain the communications function in corps and divisions operating under airland battle doctrine. In comparing the concepts I looked for deviations existing in the MSE maintenance concept. Through subjective analysis I drew my own conclusions about the sustainment capability of the MSE maintenance concept.

CHAPTER IV

FIX FORWARD AND TRI-LEVEL MAINTENANCE CONCEPTS

Since the early 1980's the U.S. Army has been operating under an operational concept of forward support maintenance. This concept has been modified by major commands for application to their units. The emphasis, however, remains on fix forward. In 1983 Training and Doctrine Command (TRADOC) published guidelines for evacuation of inoperable equipment rearward through each level of maintenance until it can be repaired or replaced (Figure 1).¹ Quite obviously, these guidelines must be adjusted based on the tactical situation facing the unit.

The fix forward concept is valuable because it allows equipment to be put back into operation as close geographically to the breakdown point as possible. This means that equipment to continue the battle is more readily available and less time is spent moving equipment back and forth through the operational area thereby reducing required personnel and transportation assets. Eventually, as more and more equipment is acquired which incorporates the fix forward concept, the more effective the Army maintenance system will be.

The four level maintenance concept used for so long in the U.S. Army is being changed to accommodate new battlefield environments as well as new equipment and new methods of employment. The levels, or categories, of organization, direct support, general support, and depot are giving way to the levels

CORPS SUPPORT AREA	DIVISION SUPPORT AREA	BDE SUPPORT AREA	BN/TF TRAINS AREA	BREAKDOWN SITE
XXX	XX	X	II	I
100 KM	50-60 KM	15-20 KM	5-10 KM	REPAIR OR EVAC?
EVAC				
96 HRS	36 HRS	24 HRS	4-6 HRS	2 HRS

REPAIR TIME LIMIT GUIDELINES

FIGURE 1

of unit, intermediate, and depot. The intermediate level is divided into intermediate direct support (IDS) and intermediate general support (IGS). (Figure 2). The tri-level maintenance structure recognizes that all equipment does not need all the levels all of the time. The desirability of this approach has been proven by this application to the aviation and strategic communication commodities as well as select communications-electronics (C-E).² In essence, the old four-level maintenance concept will remain until enough new systems designed in accordance with the tri-level concept come into the Army inventory to allow a complete phase out of the old concept.

OLD

DEPOT	GENERAL SUPPORT	DIRECT SUPPORT	ORGANIZATION
--------------	----------------------------	---------------------------	---------------------

NEW

DEPOT	INTERMEDIATE		UNIT
	GENERAL SUPPORT	DIRECT SUPPORT	

OLD AND NEW LEVELS OF MAINTENANCE
FIGURE 2

CHAPTER IV

ENDNOTES

1. US Department of the Army, TRADOC Pamphlet 525-27-1,
p. 5.
2. US Department of the Army, Army Regulation 750-1,
p. 13.

CHAPTER V

MSE MAINTENANCE CONCEPT

For the first time, on a large scale, a non-developmental item (NDI) is being procured to be used at a level of command lower than corps. Non-development items are those that were not designed and manufactured specifically for the U.S. Army. They are procured off-the-shelf. The long lead time for fielding caused by developmental activities will be eliminated with this acquisition strategy. This strategy also influenced the maintenance concept which will be used to support MSE in the field.

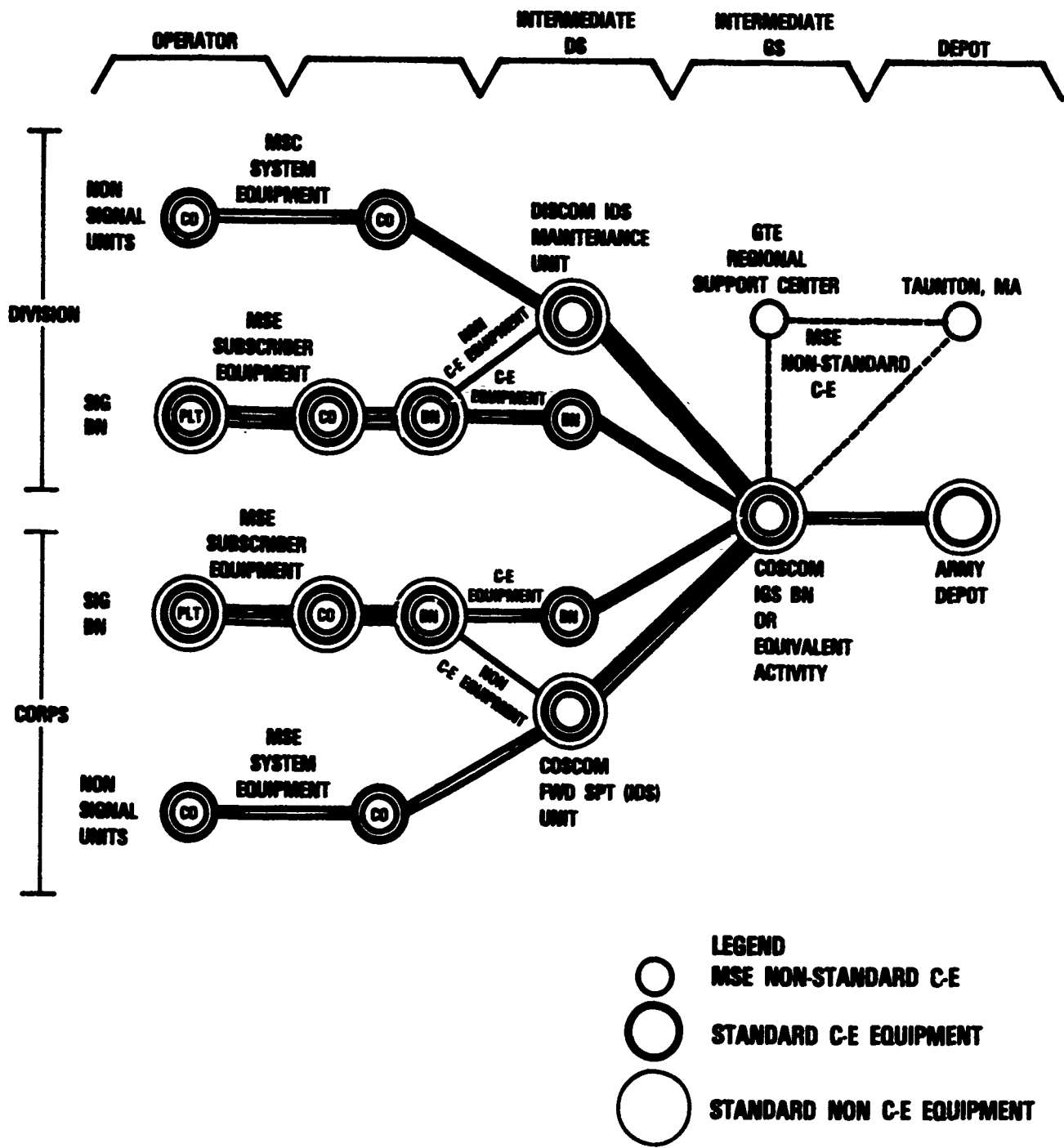
For the unit and intermediate direct support (IDS) levels of maintenance, U.S. Army personnel, facilities, and procedures will be used to make equipment repairs. At the intermediate general support (IGS) and depot levels of maintenance the contractor, GTE, will provide both maintenance and supply support using its own personnel and facilities. Standard Army procedures will be used in the portion of the system that is military. Since a contractor will be used for a significant part of the structure, an interface mechanism and procedures are required.

MSE items will go to both signal and non-signal units. Just as there are different channels of maintenance through the IDS level for signal equipment in both types of units now, this will also be the case with MSE peculiar items. Maintenance allocation charts will be used to determine the level at which repairs are to be made.

Each signal battalion, in addition to its communications mission, has the mission of IDS maintenance support for its organic signal equipment. This capability is organized within the headquarters and headquarters company of the battalion. Although the signal battalion owns and operates the majority of MSE, non-signal units, or users, will be authorized to own and operate items such as telephones and mobile subscriber radio terminals (MSRT). The IDS maintenance support mission is assigned to a Division Support Command IDS support unit for divisional units and a Corps Support Command area IDS support unit for corps non-signal units. Figure 3 depicts the maintenance flow for signal and non-signal units.¹

The IDS maintenance element in the signal battalion will be provided mobile repair and repair parts storage facilities for MSE peculiar signal equipment. These facilities will be within S250 shelter configurations.² Tools and test equipment will also be housed with the repair shelters. In cases of catastrophic failures or in cases where evacuation of inoperable equipment is not feasible, the IDS maintenance element will have the capability to send maintenance contact teams to the site of the breakdown. In reality, signal battalion commanders can send contact teams to operating sites for equipment checkouts and alignments routinely. Many system failures can be prevented by having this maintenance oversight capability.

No repair and storage facilities will be provided for the IDS support units of non-signal units. Existing repair and storage facilities are adequate to support the density and type



MSE MAINTENANCE FLOW
FIGURE 3

of MSE peculiar equipment issued to non-signal units. Tools and test equipment will be provided.

For the first year after fielding to a unit the contractor will provide personnel to perform technical assistance for MSE peculiar items.³ These personnel will be co-located with the IDS repair activity of the signal battalion and the division and corps IDS maintenance units. After the first year, this support will be available from the Regional Support Center on an on-call basis. Technical assistance will be in the form of advice, training and hands-on repair as necessary.

GTE will be more directly involved in the maintenance performed above the (IDS) level. In fact, one hundred percent of the repairs that have to be made on MSE peculiar items at both the IGS and depot maintenance levels will be the responsibility of the contractor.

The locations of the facilities, called Regional Support Centers (RSC), to accomplish this workload will be Fort Hood, TX; Fort Lewis, WA; Fort Bragg, NC; Taunton, MA; and Frankfurt, Germany. The depot will also be located at Taunton, MA. The Fort Lewis Regional Support Center will support MSE in Hawaii and Korea by providing a REACT Team at each location to provide assistance. The RSC is critical to the sustainment of MSE in both the supply and maintenance function. See Figure 4 for equipment and requisition flow.⁴

The Frankfurt facility will support both V Corps and VII Corps units with the operation of satellite activities co-located with the designated IGS support unit for each corps. Active

divisions in CONUS, which are not located near and supported by a RSC, will be supported by the Taunton RSC and depot. GTE will provide IGS and depot support for MSE peculiar items for 15 years after acceptance by the U.S. Army of the last MSE hardware items or 22 years from contract award (December 1985).

As important as the maintenance function is, it would not be adequate without the proper supply support. GTE also has the responsibility for supply support of MSE peculiar items for the life of the system as explained above.

GTE Regional Support Centers at Fort Hood, Fort Bragg, and Fort Lewis will maintain 30 days stock of critical items and items expected to have at least one demand within 90 days. For items in stock, GTE will be expected to deliver assets to the requisitioning unit within 24 hours after receipt of the materiel release order. Items which are authorized but not in stock, and items not carried because they are not authorized will be provided from the Taunton Depot to the designated supply support activity within seven days after the materiel release order is received by GTE.⁵

The GTE Support Center in Taunton will serve other CONUS units not served by the three centers mentioned above to include National Guard and Reserves during peacetime. It will maintain 75 days stock of all MSE peculiar repair items and will have the requirement to ship requisitioned items within 48 hours of receipt of the materiel release order. The items are to arrive at the supply support activity within 7 days. For items deemed critical, shipment is to be within 24 hours by the fastest means possible.⁶

The Frankfurt GTE Regional Support Center will provide IGS supply support to V Corps and VII Corps. The support center will maintain 45 days stock of critical items and items projected to have at least one demand within 180 days. For items in stock, GTE will have a requirement to deliver within three days after the materiel release order is received. Items which are authorized but not in stock, and items not carried because they are not authorized are to be provided within two weeks of receipt of a materiel release order except for critical items which will be shipped from CONUS within 48 hours after receipt of the materiel release order by the fastest means available. For items in stock at the Regional Support Center, GTE will deliver to the IDS support unit within three duty days of receipt of the materiel release order.⁷

The 2nd Infantry Division in Korea will be authorized to maintain a 90 day stock of items on the authorized stockage list (ASL). No higher level MSE peculiar stock will be maintained in Korea. The requisition flow will be from the Division Materiel Management Center to the REACT team. The REACT team will send the request to the GTE Taunton Regional Support Center. The requested items will be shipped to the REACT teams within 48 hours by air freight. The REACT Team will be required to ship failed items to Taunton within 72 hours after the items are turned in to the team.⁸

The support for the 25th Infantry Division in Hawaii is similar to that of Korea except that this division will maintain a 45 day stock of items on the ASL.

GTE will also provide the peacetime maintenance and supply support for the National Guard and the U.S. Army Reserve. Since this paper deals with only war time requirements a description of this support is not appropriate. It is worth noting, however, that the wartime maintenance support concept will be applied to both the NG and Reserves as they become mobilized for a wartime scenario. The MSE equipment spares ready-to-issue inventories by holding activity are shown at Figure 5.⁹

HOLDING ACTIVITY	RANGE			
	CRITICAL ITEMS	AT LEAST 1 DEMAND IN		
		90 DAYS	91 - 180 DAYS	180 DAYS
PLL (UNIT MAINT)	30 DAYS	30 DAYS		
ASL (IDS MAINT) US, HI, EUR	45 DAYS	45 DAYS	45 DAYS	
ASL (IDS MAINT) KOREA	90 DAYS	90 DAYS	90 DAYS	
GTE RSC GERMANY	45 DAYS	45 DAYS	45 DAYS	
GTE RSC HOOD, BRAGG, LEWIS	30 DAYS	30 DAYS		
GTE RSC TAUNTON	75 DAYS	75 DAYS	75 DAYS	75 DAYS

MSE EQUIPMENT SPARES READY TO ISSUE INVENTORIES
FIGURE 5

CHAPTER V

ENDNOTES

1. US Department of the Army, Mobile Subscriber Equipment (MSE) Integrated Logistics Support Plan (ILSP), p. B 1-2.

2. Glenn J. Strellner, "MSE Maintenance and Supply Concepts," Army Communicator, Summer 1986, p. 35.

3. US Department of the Army, Mobile Subscriber Equipment (MSE) System Material Fielding Plan, p. B 2-4.

4. Ibid., pp. B 1-27.

5. Ibid., pp. B 2-10.

6. Ibid., pp. B 2-9.

7. Ibid., pp. B 2-10.

8. Ibid., pp. B 2-11.

9. Ibid., pp. B 1-18.

CHAPTER VI

CONCLUSIONS AND RECOMMENDATIONS

From the research I have conducted I have drawn several conclusions which are listed below. I have also included some recommendations which may improve the effectiveness of the MSE maintenance concept.

A. From the very beginning the effectiveness of the MSE maintenance concept will depend largely on the number of spares placed in the system. This fact will directly affect the readiness of the complete system. Too few spares will mean that equipment will be non-mission capable awaiting the repair and return of the failed items. To a certain extent, commanders can cross-level items to minimize down time. The extent to which this practice can be effective depends on the number of identical major assemblies within which cross-leveling can be done. This practice can also be a nightmare if standard operating procedures do not include stringent control measures. In peacetime these control measures can be applied systematically. The fog of war, dispersion, movement, etc, will certainly reduce the effectiveness of cross-leveling measurably.

Realistic transportation availability and repair lead times, as well as realistic failure rates have to be used in projecting stock levels for each level of maintenance. The lack of adequate spares obviously will effect the sustainment of the system in peace or war. A poor capability to maintain the MSE system will

also reduce operator and user confidence in the operational capability of the system. I recommend that a full measure of attention be given to this aspect of the maintenance concept to prevent the underestimation of the number of spares which would provide maximum availability of the system.

B. In my estimation, one of the biggest advantages of the maintenance concept is the provision for a contractor operated depot. The life of the system involvement by the contractor should be the impetus for maintaining a warm production base. Problems with procuring repair parts, spares and major items a few years after fielding should be eliminated. The surge capability in times of need should be available. The long term involvement of the civilian contractor also has the potential for allowing more efficient equipment improvements and capability upgrades through technological advances in a shorter period of time. Clearly the Army depot system could be used to support MSE. In my opinion, however, because of the advantages listed above, the contractor operated depot will provide the best long term support for MSE.

C. Conversely, I feel the biggest detractor of this wartime maintenance concept is the provision for a totally civilian contractor operated IGS support facility. I can appreciate the advantages incurred by having the contractor's involvement for the life of the systems, but any field maintenance system which will be operated on a long term basis should be the same in peacetime as on a hostile battlefield. Bugs in the system can be worked out by those who will have to operate and manage the system and procedures in the fog of war. It will be difficult

enough to provide logistics on a dynamic battlefield without the added burden of making large adjustments. The evacuation of civilian noncombatants, in Europe for example, who will operate the facilities in peacetime would be a major adjustment to make in wartime. If a stateside corps is deployed overseas for combat it is not likely that a civilian operated maintenance facility will deploy to support the corps. So alternatives have to be sought now to insure that MSE can be supported in wartime.

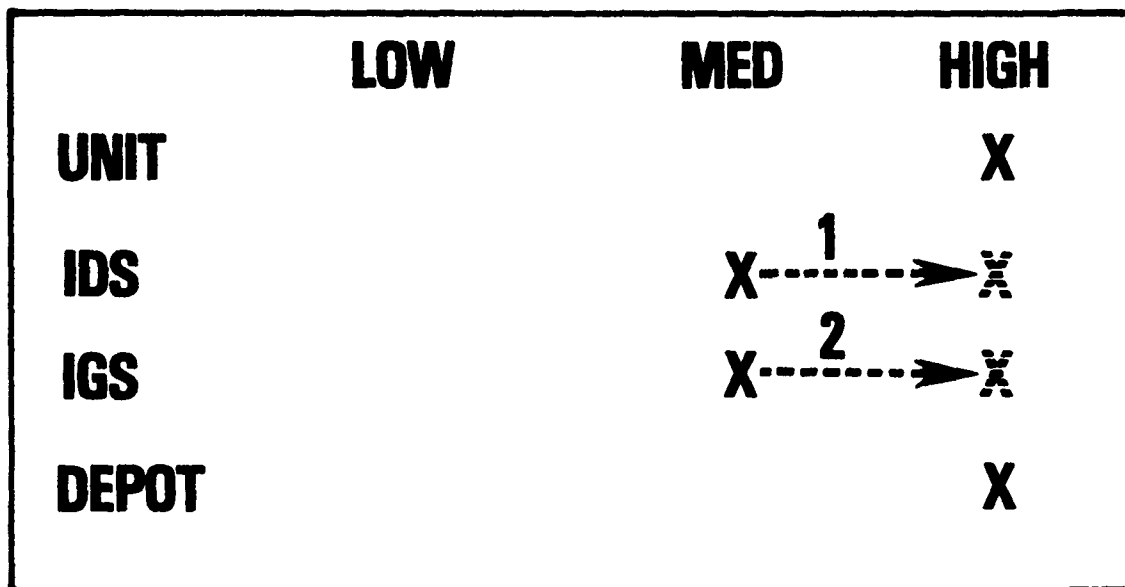
The U.S. Army has already made a commitment with a contract, but there are still alternatives. First, soldiers can be trained to perform IGS level support functions. This would require more personnel and they would have to work at that level or lose their skills. This is not a good solution since additional personnel will not be added to the support structure.

I recommend the second alternative -- plan now for the phase out of contractor operated Regional Support Centers at the outbreak of hostilities or when the contract expires, whichever comes first. The plan should be based on the concept of forward maintenance which is planned for the 2nd Infantry Division in Korea where a higher level stock of MSE peculiar ASL will be maintained by the IDS level support activities. The improved stock levels should be included in contingency plans and budgeted for. The only adjustments that would have to be made would be for evacuation procedures for failed MSE items. Essentially an evacuation system exists now for other signal items. MSE items would have to be added to the list of items to be evacuated.

D. The framers of the MSE concept have done an admirable job. Consideration was given to the fix forward and tri-level

maintenance concepts. This was no easy task considering that MSE is a NDI program which to a large degree eliminates the design stage of development. Maximum use of the existing Army logistics system was incorporated. Interface procedures between contractor and Army procedures have been planned. These procedures are critical in providing a cost-monitoring mechanism for the entire operation.

In my opinion, the maintenance concept for MSE as it is presently designed, will provide a medium to high system availability. In order to build user confidence from the start high availability is essential. My subjective evaluation of the maintenance concept is depicted at Figure 6. First, I believe that the provisions for an adequate number of spares at the IDS maintenance level is critical in insuring a high systems availability. Second, contingency plans must be made for an increased number of spares at the IDS maintenance level to replace a peacetime civilian operated IGS facility which would cease to exist during wartime.



NOTES: CONCEPT CAN BE IMPROVED BY

- 1. INSURANCE OF ADEQUATE NUMBER OF SPARES**
- 2. CONTINGENCY PLANS FOR INCREASED NUMBER OF SPARES AT IDS UNITS FOR WARTIME OPERATION**

MSE MAINTENANCE CONCEPT EFFECTIVENESS

FIGURE 6

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